

RESRAD PROGRAM

The EAD staff developed the RESRAD family of computer codes to provide a scientifically based answer to the question “how clean is clean” and to provide useful tools for evaluating human health risk from residual contamination. The parent RESRAD code has been widely used in the United States and abroad and approved by many federal and state agencies for site cleanup evaluations. The RESRAD codes have proven to be useful tools in evaluating both radiologically and chemically contaminated sites and have resulted in significant savings in cleanup costs.

■ PROBLEM/OPPORTUNITY

The potential risk to human health and the environment is a primary consideration when federal agencies make environmental policies and decisions. Specific questions such as “how clean is clean?” cannot be answered without a scientific basis and without adequate consideration of risk potentials. The evaluation of possible impacts on human health and ecological systems from exposure to radioactive and chemical contaminants often requires the modeling of contaminant transport.

■ APPROACH

Under the sponsorship of the U.S. Department of Energy (DOE), EAD has developed the RESRAD family of computer codes to assess human health and environmental risk at sites contaminated with radioactive materials and hazardous chemicals. The RESRAD codes can be used to evaluate chemical and radiological contaminants, real (land and buildings) and non-real properties (furniture, tools, and scrap metals), human and ecological receptors, and on-site and off-site receptor locations. The user-friendly interfaces and help systems of all the codes minimize user learning time and facilitate ease of use.

The RESRAD codes include (1) RESRAD, for soil contaminated with radionuclides; (2) RESRAD-BUILD, for buildings contaminated with radio-

nuclides; (3) RESRAD-CHEM, for soil contaminated with hazardous chemicals; (4) RESRAD-BASELINE, for risk assessments against measured (baseline) concentrations of both radionuclides and chemicals in environmental media; (5) RESRAD-ECORISK, for ecological risk assessments; (6) RESRAD-RECYCLE, for recycle and reuse of radiologically contaminated metals and equipment; and (7) RESRAD-OFFSITE, for off-site receptor dose/risk assessment. Four of these codes (RESRAD and RESRAD-BUILD, -RECYCLE, and -OFFSITE) include uncertainty analysis capabilities that allow the user to input distributions of parameters.

RESRAD-RECYCLE and -OFFSITE are the most recent additions to the RESRAD family. The RESRAD-RECYCLE code currently evaluates the recycling of steel and aluminum. It differs from the other RESRAD codes in that it is scenario driven; currently 41 scenarios are considered. RESRAD-OFFSITE is an extension of the parent RESRAD (on-site) code. RESRAD-OFFSITE evaluates concentrations of radionuclides in off-site well water and radiological doses for off-site receptors. It also links with the U.S. Environmental Protection Agency’s (EPA’s) CAP88 for off-site air dispersion calculations. Recent improvements to the RESRAD codes include the addition of an inhalation pathway area factor, an external dose model, and a tritium model.

■ RESULTS

The RESRAD code has been used for cleanup and risk evaluations at more than 300 sites in the United States and other countries. RESRAD is the most extensively tested, verified, and validated code in the area of environmental risk assessment and site cleanup. It is the only computer code designated in DOE Order 5400.5 for the evaluation of radioactively contaminated sites. The U.S. Nuclear Regulatory Commission (NRC) also has approved use of RESRAD for dose evaluation for decommissioning and waste disposal at licensed nuclear facilities. The EPA used RESRAD in its rulemaking for cleanup of sites contaminated with radioactivity, and several state agencies have approved the use of RESRAD for evaluating site cleanup activities. The RESRAD family of codes has been used at many universities as a teaching and research tool, and many theses and papers have been based on various aspects and applications of the codes. In addition, about 1,000 people have been trained in the use of RESRAD, RESRAD-BUILD, and RESRAD-RECYCLE at more than 80 training workshops.

■ HISTORY/STATUS/FUTURE

EAD established the RESRAD program more than 10 years ago. DOE is the primary sponsor; others include the EPA and utility companies. The NRC is currently sponsoring the development of statistically based default parameters for RESRAD for use

by NRC licensees on license termination applications. EAD will continue to improve and update the current models, develop new tools for risk assessment, conduct training workshops, and provide assistance in applying these models to actual sites.

The RESRAD codes have recently been used by many foreign countries, and EAD will seek additional opportunities for international collaboration and for application of the RESRAD codes to solve international and global environmental problems.

■ COMMUNICATION OF RESULTS

The RESRAD team has cooperated with the interagency standards committee and has provided technical assistance to DOE on issues like site cleanup and recycle of contaminated metals. A Web site (<http://www.ead.anl.gov/resrad>) established in 1995 provides information about the RESRAD codes, recent updates, and upcoming workshops; permits downloading of patch files; and serves as a communication channel for questions and support. A user database is maintained and used for distributing news and code update information. Many reports and papers have been published to support the use of the RESRAD family of codes and to disseminate results of specific applications of the codes.

Comparison of RESRAD Family of Codes

Computer Code	Source of Contamination	Type of Contamination	Spreading of Contaminants	End Point of Concern	Operating System	Code Availability	Probabilistic Code
RESRAD	Soil	Radionuclides	On-site environmental media	Human health	Windows	Distributed	Yes
RESRAD-BUILD	Buildings	Radionuclides	Rooms in a building	Human health	Windows	Distributed	Yes
RESRAD-CHEM	Soil	Chemicals	Environmental media	Human health	DOS	Test and evaluation	No
RESRAD-BASELINE	Not specified (all media)	Radionuclides and chemicals	Environmental media	Human health	Windows	Test and evaluation	No
RESRAD-RECYCLE	Scrap metals	Radionuclides	Air, intermediate, and end products	Human health	Windows	Test and evaluation	Yes
RESRAD-ECORISK	Soil	Chemicals	Environmental media	Ecological systems	DOS	Test and evaluation	No
RESRAD-OFFSITE	Soil	Radionuclides	On-site and off-site environmental media	Human health	Windows	Test and evaluation	Yes

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